

Preliminary Classification:

Proposed Class:

Subclass:

NOTE: "All applicants are requested to include a preliminary classification on newly filed patent applications. The preliminary classification, preferably class and subclass designations, should be identified in the upper right-hand corner of the letter of transmittal accompanying the application papers, for example 'Proposed Class 2, subclass 129.' M.P.E.P. § 601, 7th ed.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Box Patent Application
Assistant Commissioner for Patents
Washington, D.C. 20231

NEW APPLICATION TRANSMITTAL

Transmitted herewith for filing is the patent application of
Inventor(s): Janne PARANTAINEN

WARNING: 37 C.F.R. § 1.41(a)(1) points out:

"(a) A petition is applied for in the name or names of the actual inventor or inventors.

"(1) The inventorship of a nonprovisional application is that inventorship set forth in the oath or declaration as prescribed by § 1.63, except as provided for in § 1.53(d)(4) and § 1.63(d). If an oath or declaration as prescribed by § 1.63 is not filed during the pendency of a nonprovisional application, the inventorship is that inventorship set forth in the application papers filed pursuant to § 1.53(b), unless a petition under this paragraph accompanied by the fee set forth in § 1.17(f) is filed supplying or changing the name or names of the inventor or inventors."

For (title): METHOD AND ARRANGEMENT FOR CHOOSING A CHANNEL CODING AND INTERLEAVING SCHEME FOR CERTAIN TYPES OF PACKET DATA CONNECTIONS

CERTIFICATION UNDER 37 C.F.R. § 1.10*

(Express Mail label number is mandatory.)
(Express Mail certification is optional.)

I hereby certify that this New Application Transmittal and the documents referred to as attached therein are being deposited with the United States Postal Service on this date June 15, 2000 in an envelope as "Express Mail Post Office to Addressee," mailing Label Number E1627420250US addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

Sauna Murphy

(type or print name of person mailing paper)

Sauna Murphy

Signature of person mailing paper

WARNING: Certificate of mailing (first class) or facsimile transmission procedures of 37 C.F.R. § 1.8 cannot be used to obtain a date of mailing or transmission for this correspondence.

***WARNING:** Each paper or fee filed by "Express Mail" must have the number of the "Express Mail" mailing label placed thereon prior to mailing. 37 C.F.R. § 1.10(b).

"Since the filing of correspondence under § 1.10 without the Express Mail mailing label thereon is an oversight that can be avoided by the exercise of reasonable care, requests for waiver of this requirement will not be granted on petition." Notice of Oct. 24, 1996, 60 Fed. Reg. 56,493, at 56,442.

(New Application Transmittal [4-1]—page 1 of 11)

06/15/00
JC662 U.S. PTO

JC611 U.S. PTO
09/595275
06/15/00

00595275-001500

1. Type of Application

This new application is for a(n)

(check one applicable item below)

- ☒ Original (nonprovisional)
☐ Design
☐ Plant

WARNING: Do not use this transmittal for a completion in the U.S. of an International Application under 35 U.S.C. § 371(c)(4), unless the International Application is being filed as a divisional, continuation or continuation-in-part application.

WARNING: Do not use this transmittal for the filing of a provisional application.

NOTE: If one of the following 3 items apply, then complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF A PRIOR U.S. APPLICATION CLAIMED and a NOTIFICATION IN PARENT APPLICATION OF THE FILING OF THIS CONTINUATION APPLICATION.

- ☐ Divisional.
☐ Continuation.
☐ Continuation-in-part (C-I-P).

2. Benefit of Prior U.S. Application(s) (35 U.S.C. §§ 119(e), 120, or 121)

NOTE: A nonprovisional application may claim an invention disclosed in one or more prior filed copending nonprovisional applications or copending international applications designating the United States of America. In order for a nonprovisional application to claim the benefit of a prior filed copending nonprovisional application or copending international application designating the United States of America, each prior application must name as an inventor at least one inventor named in the later filed nonprovisional application and disclose the named inventor's invention claimed in at least one claim of the later filed nonprovisional application in the manner provided by the first paragraph of 35 U.S.C. § 112. Each prior application must also be:

(i) An international application entitled to a filing date in accordance with PCT Article 11 and designating the United States of America; or

(ii) Complete as set forth in § 1.51(b); or

(iii) Entitled to a filing date as set forth in § 1.53(b) or § 1.53(d) and include the basic filing fee set forth in § 1.16; or

(iv) Entitled to a filing date as set forth in § 1.53(b) and have paid therein the processing and retention fee set forth in § 1.21(f) within the time period set forth in § 1.53(f).

37 C.F.R. § 1.78(e)(1).

NOTE: If the new application being transmitted is a divisional, continuation or a continuation-in-part of a parent case, or where the parent case is an International Application which designated the U.S., or benefit of a prior provisional application is claimed, then check the following item and complete and attach ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

WARNING: If an application claims the benefit of the filing date of an earlier filed application under 35 U.S.C. §§ 120, 121 or 365(c), the 20-year term of that application will be based upon the filing date of the earliest U.S. application that the application makes reference to under 35 U.S.C. §§ 120, 121 or 365(c). (35 U.S.C. § 154(a)(2) does not take into account, for the determination of the patent term, any application on which priority is claimed under 35 U.S.C. §§ 119, 365(a) or 365(b).) For a c-i-p application, applicant should review whether any claim in the patent that will issue is supported by an earlier application and, if not, the applicant should consider canceling the reference to the earlier filed application. The term of a patent is not based on a claim-by-claim approach. See Notice of April 14, 1995, 60 Fed. Reg. 20,195, at 20,205.

(New Application Transmittal [4-1]—page 2 of 11)

WARNING: When the last day of pendency of a provisional application falls on a Saturday, Sunday, or Federal holiday within the District of Columbia, any nonprovisional application claiming benefit of the provisional application must be filed prior to the Saturday, Sunday, or Federal holiday within the District of Columbia. See 37 C.F.R. § 1.78(a)(3).

- ☐ The new application being transmitted claims the benefit of prior U.S. application(s). Enclosed are ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

3. Papers Enclosed

- A. Required for filing date under 37 C.F.R. § 1.53(b) (Regular) or 37 C.F.R. § 1.153 (Design) Application

10 Pages of specification

2 Pages of claims

4 Sheets of drawing

WARNING: DO NOT submit original drawings. A high quality copy of the drawings should be supplied when filing a patent application. The drawings that are submitted to the Office must be on strong, white, smooth, and non-shiny paper and meet the standards according to § 1.84. If corrections to the drawings are necessary, they should be made to the original drawing and a high-quality copy of the corrected original drawing then submitted to the Office. Only one copy is required or desired. For comments on proposed then-new 37 C.F.R. § 1.84, see Notice of March 9, 1988 (1990 O.G. 57-62).

NOTE: "Identifying indicia, if provided, should include the application number or the title of the invention, inventor's name, docket number (if any), and the name and telephone number of a person to call if the Office is unable to match the drawings to the proper application. This information should be placed on the back of each sheet of drawing a minimum distance of 1.5 cm. (5/8 inch) down from the top of the page . . ." 37 C.F.R. § 1.84(c).

(complete the following, if applicable)

- ☐ The enclosed drawing(s) are photograph(s), and there is also attached a "PETITION TO ACCEPT PHOTOGRAPH(S) AS DRAWING(S)." 37 C.F.R. § 1.84(b).

- ☐ formal
☐ informal

B. Other Papers Enclosed

 Pages of declaration and power of attorney

1 Pages of abstract

 Other

4. Additional papers enclosed

- ☐ Amendment to claims
- ☐ Cancel in this applications claims _____ before calculating the filing fee. (At least one original independent claim must be retained for filing purposes.)
- ☐ Add the claims shown on the attached amendment. (Claims added have been numbered consecutively following the highest numbered original claims.)
- ☐ Preliminary Amendment
- ☐ Information Disclosure Statement (37 C.F.R. § 1.98)
- ☐ Form PTO-1449 (PTO/SB/08A and 08B)
- ☐ Citations

(New Application Transmittal [4-1]—page 3 of 11)

RECEIVED 11/15/90

- ☐ Declaration of Biological Deposit
- ☐ Submission of "Sequence Listing," computer readable copy and/or amendment pertaining thereto for biotechnology invention containing nucleotide and/or amino acid sequence.
- ☐ Authorization of Attorney(s) to Accept and Follow Instructions from Representative
- ☐ Special Comments
- ☐ Other

5. Declaration or oath (including power of attorney)

NOTE: A newly executed declaration is not required in a continuation or divisional application provided that the prior nonprovisional application contained a declaration as required, the application being filed is by all or fewer than all the inventors named in the prior application, there is no new matter in the application being filed, and a copy of the executed declaration filed in the prior application (showing the signature or an indication thereon that it was signed) is submitted. The copy must be accompanied by a statement requesting deletion of the names of person(s) who are not inventors of the application being filed. If the declaration in the prior application was filed under § 1.47, then a copy of that declaration must be filed accompanied by a copy of the decision granting § 1.47 status or, if a nonsigning person under § 1.47 has subsequently joined in a prior application, then a copy of the subsequently executed declaration must be filed. See 37 C.F.R. §§ 1.63(d)(1)-(3).

NOTE: A declaration filed to complete an application must be executed, identify the specification to which it is directed, identify each inventor by full name including family name and at least one given name, without abbreviation together with any other given name or initial, and the residence, post office address and country or citizenship of each inventor, and state whether the inventor is a sole or joint inventor. 37 C.F.R. § 1.63(a)(1)-(4).

- ☐ Enclosed

Executed by

(check all applicable boxes)

- ☐ inventor(s).
- ☐ legal representative of inventor(s).
37 C.F.R. §§ 1.42 or 1.43.
- ☐ joint inventor or person showing a proprietary interest on behalf of inventor who refused to sign or cannot be reached.

- ☐ This is the petition required by 37 C.F.R. § 1.47 and the statement required by 37 C.F.R. § 1.47 is also attached. See item 13 below for fee.

- ☒ Not Enclosed.

NOTE: Where the filing is a completion in the U.S. of an International Application or where the completion of the U.S. application contains subject matter in addition to the International Application, the application may be treated as a continuation or continuation-in-part, as the case may be, utilizing ADDED PAGE FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION CLAIMED.

- ☒ Application is made by a person authorized under 37 C.F.R. § 1.41(c) on behalf of all the above named inventor(s).

(The declaration or oath, along with the surcharge required by 37 C.F.R. § 1.16(e) can be filed subsequently).

- ☐ Showing that the filing is authorized.
(not required unless called into question. 37 C.F.R. § 1.41(d))

(New Application Transmittal [4-1]—page 4 of 11)

00565275-001500

6. Inventorship Statement

WARNING: If the named inventors are each not the inventors of all the claims an explanation, including the ownership of the various claims at the time the last claimed invention was made, should be submitted.

The inventorship for all the claims in this application are:

☐ The same.

or

☐ Not the same. An explanation, including the ownership of the various claims at the time the last claimed invention was made,

☐ is submitted.

☐ will be submitted.

7. Language

NOTE: An application including a signed oath or declaration may be filed in a language other than English. An English translation of the non-English language application and the processing fee of \$130.00 required by 37 C.F.R. § 1.17(d) is required to be filed with the application, or within such time as may be set by the Office. 37 C.F.R. § 1.52(d).

☒ English

☐ Non-English

☐ The attached translation includes a statement that the translation is accurate. 37 C.F.R. § 1.52(d).

8. Assignment

☒ An assignment of the invention to Nokia Mobile Phones Ltd.

☐ is attached. A separate ☐ "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or ☐ FORM PTO 1595 is also attached.

☒ will follow.

NOTE: "If an assignment is submitted with a new application, send two separate letters—one for the application and one for the assignment." Notice of May 4, 1990 (1114 O.G. 77-78).

WARNING: A newly executed "CERTIFICATE UNDER 37 C.F.R. § 3.73(b)" must be filed when a continuation-in-part application is filed by an assignee. Notice of April 30, 1993, 1150 O.G. 62-64.

(New Application Transmittal [4-1]—page 5 of 11)

9. Certified Copy

Certified copy(ies) of application(s)

Country	Appln. No.	Filed
Finland	991382	16 June 1999

Country	Appln. No.	Filed
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Country	Appln. No.	Filed
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from which priority is claimed

☐ Is (are) attached.☒ will follow.

NOTE: The foreign application forming the basis for the claim for priority must be referred to in the oath or declaration. 37 C.F.R. § 1.55(a) and 1.63.

NOTE: This item is for any foreign priority for which the application being filed directly relates. If any parent U.S. application or International Application from which this application claims benefit under 35 U.S.C. § 120 is itself entitled to priority from a prior foreign application, then complete item 18 on the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED.

10. Fee Calculation (37 C.F.R. § 1.16)A. ☒ Regular application

CLAIMS AS FILED				
Number filed	Number Extra	Rate	Basic Fee 37 C.F.R. § 1.16(a) \$ 690.00	
Total				
Claims (37 C.F.R. § 1.16(c))				
6	- 20 =	0	×	\$ 18.00
Independent				
Claims (37 C.F.R. § 1.16(b))				
2	- 3 =	0	×	\$ 78.00
Multiple dependent claim(s).				
If any (37 C.F.R. § 1.16(d))		+	\$260.00	

- ☐ Amendment cancelling extra claims is enclosed.
- ☐ Amendment deleting multiple-dependencies is enclosed.
- ☐ Fee for extra claims is not being paid at this time.

NOTE: If the fees for extra claims are not paid on filing they must be paid or the claims cancelled by amendment, prior to the expiration of the time period set for response by the Patent and Trademark Office in any notice of fee deficiency. 37 C.F.R. § 1.16(d).

Filing Fee Calculation \$ 690.00

B. ☐ Design application
(\$310.00—37 C.F.R. § 1.16(f))

Filing Fee Calculation \$

C. ☐ Plant application
(\$480.00—37 C.F.R. § 1.16(g))

Filing fee calculation \$

11. Small Entity Statement(s)

- ☐ Statement(s) that this is a filing by a small entity under 37 C.F.R. § 1.9 and 1.27 is (are) attached.

WARNING: "Status as a small entity must be specifically established in each application or patent in which the status is available and desired. Status as a small entity in one application or patent does not affect any other application or patent, including applications or patents which are directly or indirectly dependent upon the application or patent in which the status has been established. The refile of an application under § 1.53 as a continuation, division, or continuation-in-part (including a continued prosecution application under § 1.53(d)), or the filing of a reissue application requires a new determination as to continued entitlement to small entity status for the continuing or reissue application. A nonprovisional application claiming benefit under 35 U.S.C. § 119(e), 120, 121, or 365(c) of a prior application, or a reissue application may rely on a statement filed in the prior application or in the patent if the nonprovisional application or the reissue application includes a reference to the statement in the prior application or in the patent or includes a copy of the statement in the prior application or in the patent and status as a small entity is still proper and desired. The payment of the small entity basic statutory filing fee will be treated as such a reference for purposes of this section." 37 C.F.R. § 1.28(a)(2).

WARNING: "Small entity status must not be established when the person or persons signing the . . . statement can unequivocally make the required self-certification." M.P.E.P., § 509.03, 6th ed., rev. 2, July 1996 (emphasis added).

(complete the following, if applicable)

- ☐ Status as a small entity was claimed in prior application _____ / _____, filed on _____, from which benefit is being claimed for this application under:

35 U.S.C. § ☐ 119(e),
☐ 120,
☐ 121,
☐ 365(c),

and which status as a small entity is still proper and desired.

- ☐ A copy of the statement in the prior application is included.

Filing Fee Calculation (50% of A, B or C above)

\$ _____

NOTE: Any excess of the full fee paid will be refunded if small entity status is established and a refund request are filed within 2 months of the date of timely payment of a full fee. The two-month period is not extendable under § 1.136. 37 C.F.R. § 1.28(a).

12. Request for International-Type Search (37 C.F.R. § 1.104(d))

(complete, if applicable)

- ☐ Please prepare an international-type search report for this application at the time when national examination on the merits takes place.

13. Fee Payment Being Made at This Time

☐ Not Enclosed

☐ No filing fee is to be paid at this time.
(This and the surcharge required by 37 C.F.R. § 1.16(e) can be paid subsequently.)

☒ Enclosed

- ☒ Filing fee \$ 690.00
- ☐ Recording assignment
(\$40.00; 37 C.F.R. § 1.21(h))
(See attached "COVER SHEET FOR
ASSIGNMENT ACCOMPANYING NEW
APPLICATION".) \$ _____
- ☐ Petition fee for filing by other than all the
inventors or person on behalf of the inventor
where inventor refused to sign or cannot be
reached
(\$130.00; 37 C.F.R. §§ 1.47 and 1.17(i)) \$ _____
- ☐ For processing an application with a
specification in
a non-English language
(\$130.00; 37 C.F.R. §§ 1.52(d) and 1.17(k)) \$ _____
- ☐ Processing and retention fee
(\$130.00; 37 C.F.R. §§ 1.53(d) and 1.21(f)) \$ _____
- ☐ Fee for international-type search report
(\$40.00; 37 C.F.R. § 1.21(e)) \$ _____

NOTE: 37 C.F.R. § 1.21(f) establishes a fee for processing and retaining any application that is abandoned for failing to complete the application pursuant to 37 C.F.R. § 1.53(f) and this, as well as the charges to 37 C.F.R. §§ 1.53 and 1.78(a)(1), indicate that in order to obtain the benefit of a prior U.S. application, either the basic filing fee must be paid, or the processing and retention fee of § 1.21(f) must be paid, within 1 year from notification under § 53(f).

Total fees enclosed \$ 690.00

14. Method of Payment of Fees

- ☒ Check in the amount of \$ 690.00
- ☐ Charge Account No. _____ in the amount of \$ _____

A duplicate of this transmittal is attached.

NOTE: Fees should be itemized in such a manner that it is clear for which purpose the fees are paid. 37 C.F.R. § 1.22(b).

15. Authorization to Charge Additional Fees

WARNING: If no fees are to be paid on filing, the following items should not be completed.

WARNING: Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges, if extra claim charges are authorized.

- ☒ The Commissioner is hereby authorized to charge the following additional fees by this paper and during the entire pendency of this application to Account No. 16-1350:

☒ 37 C.F.R. § 1.16(a), (f) or (g) (filing fees)

☒ 37 C.F.R. § 1.16(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.16(d)), it might be best not to authorize the PTO to charge additional claim fees, except possibly when dealing with amendments after final action.

☒ 37 C.F.R. § 1.16(e) (surcharge for filing the basic filing fee and/or declaration on a date later than the filing date of the application)

☒ 37 C.F.R. § 1.17(a)(1)-(5) (extension fees pursuant to § 1.136(a)).

☐ 37 C.F.R. § 1.17 (application processing fees)

NOTE: "... A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

☐ 37 C.F.R. § 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. § 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. § 1.28(b) requires "Notification of any change in status resulting in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying, . . . the issue fee. . . ." From the wording of 37 C.F.R. § 1.28(b), (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

(New Application Transmittal [4-1]—page 9 of 11)

16. Instructions as to Overpayment

NOTE: "... Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

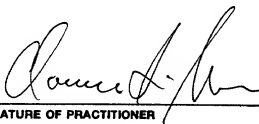
- ☒ Credit Account No. 16-1350
☐ Refund

SEND ALL CORRESPONDENCE TO:

Reg. No. 24,622

Tel. No. (203) 259-1800

Customer No. 2512



SIGNATURE OF PRACTITIONER

Clarence A. Green

(type or print name of attorney)

PERMAN & GREEN, LLP

P.O. Address

425 Post Road, Fairfield, Connecticut 06430

(New Application Transmittal [4-1]—page 10 of 11)

☐ **Incorporation by reference of added pages**

(check the following item if the application in this transmittal claims the benefit of prior U.S. application(s) (including an international application entering the U.S. stage as a continuation, divisional or C-I-P application) and complete and attach the ADDED PAGES FOR NEW APPLICATION TRANSMITTAL WHERE BENEFIT OF PRIOR U.S. APPLICATION(S) CLAIMED)

- ☐ Plus Added Pages for New Application Transmittal Where Benefit of Prior U.S. Application(s) Claimed

Number of pages added _____

- ☐ Plus Added Pages for Papers Referred to in Item 4 Above

Number of pages added _____

- ☐ Plus added pages deleting names of inventor(s) named in prior application(s) who is/are no longer inventor(s) of the subject matter claimed in this application.

Number of pages added _____

- ☐ Plus "Assignment Cover Letter Accompanying New Application"

Number of pages added _____

☒ **Statement Where No Further Pages Added**

(if no further pages form a part of this Transmittal, then end this Transmittal with this page and check the following item)

- ☒ This transmittal ends with this page.

TITLE: Method and arrangement for choosing a channel coding and interleaving scheme for certain types of packet data connections

5 **TECHNOLOGICAL FIELD**

10 The invention concerns generally the technology of adapting, according to the needs of the current connection using a radio interface, the channel coding and other signal processing used in association with the radio interface. Especially the invention concerns the selection of channel coding and interleaving scheme associated with a radio interface for packet data communications. As an example of a communication system employing such a radio interface we will consider the General Packet Radio Service or GPRS system which is under specification at the priority date of this patent application. The invention is equally well applicable for example to the 15 Universal Mobile Telecommunication System or UMTS, where a connectionless mode has been defined for packet data communication.

20 **BACKGROUND OF THE INVENTION**

25 The current version of the standardized GPRS system contains four mutually alternative channel coding schemes, which are known as CS-1, CS-2, CS-3 and CS-4. Error correction is based on retransmissions, meaning that the receiving device must acknowledge successfully received packets. Retransmission of unacknowledged packets is attempted until the reception is successful or the packets must be discarded due to a time limit. The decision of which channel coding scheme should be used in each communication connection is on the responsibility of the Packet Control Unit or PCU which is typically a part of the Base Station Subsystem or BSS; more particularly a PCU typically operates at the Base Station Controller or 30 BSC, at the Base Transceiver Station or BTS (also known shortly as the Base Station or BS) or even at a Serving GPRS Support Node or SGSN. The channel coding scheme of a certain communication connection can be dynamically changed according to need. For example in a connection where frequent retransmissions of unsuccessfully received packets are observed it may be worthwhile to introduce a 35 stronger channel coding scheme. Increasing the amount of channel coding lowers the throughput of actual data per packet, so when the connection quality is otherwise good it is advantageous to keep the amount of channel coding fairly low. All said GPRS channel coding schemes are associated with interleaving over a RLC block

period (Radio Link Control) which is equal to the duration of four consecutive transmission frames.

The problem of the GPRS radio interface, as well as of many other radio interfaces for packet data communications, viewed in the context of the present invention, is that they are optimized for the transmission of data, meaning particularly the non-real time transmission of files and messages. This is understandable as such, because the packet-switched radio transmission systems have been regarded as logical extensions of wired networks for packet-switched communication between computers. Delay-critical applications such as the real-time transmission of speech and video have had their own circuit-switched transmission systems. Recently, however, applications have arisen that use the packet data networks for the real-time transmission of speech and even images. An example is the technology of Internet calls, where an audio and/or video telephone call is conducted through the Internet.

If we attempt to use the known GPRS radio interface or the known UMTS connectionless-based radio interface to conduct a telephone call or a real time video transmission, we are typically faced either with a relatively large number of retransmissions or a choice of strong channel coding. The former is contradictory to the requirement of real time and the latter lowers the throughput of actual data to an unacceptable level for the transmission of speech or images with a reasonable quality. The relatively short interleaving length makes the situation even worse, because it weakens the performance of the radio interface against bursty transmission errors.

An obvious solution for enhancing the applicability of packet data radio interfaces to the transmission of real time audio and/or video would be to specify at least one specific bearer type for them. Examples of channel coding and interleaving optimized for the transmission of real time audio and/or video are abundant in the field of digital mobile telephony, so the person skilled in the art would have no difficulties in specifying suitable characteristics for a "speech bearer" of the like in association with e.g. GPRS. However, it is not obvious how and when should it be decided to allocate such a bearer to a certain connection that is to be set up.

SUMMARY OF THE INVENTION

It is an object of the present invention to present a method and an arrangement for choosing a channel coding and/or interleaving scheme for a packet data communication connection based on the requirements of that connection. It is a further object of the invention that it is flexibly applicable to different kinds of present and future connection types.

The objects of the invention are achieved by defining the requirements of a communication connection in terms of a Quality of Service profile and by mapping the Quality of Service profiles into certain previously determined channel coding and/or interleaving schemes.

It is characteristic to the method according to the invention that it comprises the steps of

- communicating a request message to the decision-making device, said request message indicating a certain set of Quality of Service parameters associated with a certain first communication connection,
- mapping said set of Quality of Service parameters to a certain first channel coding and/or interleaving scheme as a part of the channel coding and/or interleaving scheme allocation made by the decision-making device and
- communicating said first channel coding and/or interleaving scheme to the base station and the terminal for them to apply said first channel coding and/or interleaving scheme in said first communication connection.

The invention applies also to an arrangement that comprises as characteristic features

- within a terminal and a base station, means for communicating a request message to a decision-making device, and means for indicating within said request message a certain set of Quality of Service parameters associated with a certain first communication connection,
- within the decision making device, means for mapping said set of Quality of Service parameters to a certain first channel coding and/or interleaving scheme as a part of the channel coding and/or interleaving scheme allocation and
- means for communicating said first channel coding and/or interleaving scheme to the base station and the terminal for them to apply said first channel coding and/or interleaving scheme in said first communication connection

The concept of Quality of Service or QoS has been previously introduced to describe various kinds of service requirements or bearer capabilities in terms of a

number of parameters. Typical QoS parameters include but are not limited to mean delay, maximum delay, service precedence, bearer class, mean bitrate, maximum bitrate, minimum bitrate and so on. A known step of setting up a new communication connection or updating the characteristics of an existing communication connection between a mobile station and a telecommunication network is a negotiation of QoS parameters, where the initiator or device requesting the setup or change of a connection suggests a certain set of QoS parameter values to be applied. The responder or other device taking part in the communication may answer by either accepting the proposed QoS parameter values or announcing the "best possible" set of values which it can offer at the moment, whereby it is on the responsibility of the initiator to either go on with the connection setup/change process or to terminate it.

According to the invention the known procedure of QoS negotiation is utilized and extended so that there exists a certain correspondence between a set of QoS parameter values and a predetermined channel coding and/or interleaving scheme. The device which requests the setup of a new communication connection or a change in an existing communication connection chooses the set of QoS parameter values to be suggested in the QoS negotiation process so that they take into account the real time / non-real time nature of the desired connection as well as other features that may affect the choice of an optimal channel coding and/or interleaving scheme. For example there may be certain known QoS parameter value combinations indicating voice traffic, interactive video or non-real time data. The selected QoS parameter value combinations are communicated to the device which decides the applied channel coding and/or interleaving schemes. A certain mapping has been determined for this device so that based on the communicated parameter values the device is able to choose the optimal channel coding and/or interleaving scheme for each connection.

BRIEF DESCRIPTION OF DRAWINGS

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

Fig. 1 illustrates a network-level arrangement according to the invention,

Fig. 2 illustrates a first aspect of a method according to the invention,

5 Fig. 3 illustrates a second aspect of a method according to the invention and

Fig. 4 schematically illustrates a mobile station according to the invention.

10 DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 illustrates an arrangement consisting of a mobile station or MS 101, a base station or BS 102, a packet control unit or PCU 103 coupled to a base station controller or BSC 104, a GPRS network 105 as well as a number of connections
 15 from said devices to other parts of the telecommunication system. There is a radio interface between the MS 101 and the BS 102, a wired connection and/or e.g. a directional microwave link between the BS 102 and the BSC 104 and a wired or optical fibre connection between the PCU 103 and the GPRS network 105. With a GPRS network we mean a widespread arrangement of mutually interconnected
 20 computers comprising a number of Serving GPRS Support Nodes (SGSNs) and Gateway GPRS Support Nodes (GGSNs) operating in accordance with the known GPRS specifications. The hardware of all parts shown in Fig. 1 is known as such. The arrangement of Fig. 1 is shown as an exemplary collection of hardware that can be used for implementing the present invention. It should be noted that the invention
 25 is in no way limited by the terminology used in association with Fig. 1: for example in the third-generation UMTS digital cellular network (Universal Mobile Telecommunication System) the concept of RANs or Radio Access Networks is introduced where a radio network controller or an RNC performs functions essentially similar to those of the BSC 104, and the mobile station is known as the
 30 User Equipment or UE.

It is known from prior art that an MS is capable of generating requests for setting up new bearers over the radio interface and in some cases for redefining the characteristics of existing bearers. It is likewise known from prior art that such a
 35 request may comprise, within appropriate fields, a selection of QoS parameter values which the MS would like the new or redefined bearer to have. According to an advantageous embodiment of the invention the MS 101 is arranged to select the QoS parameter values that it will send within a request of the mentioned type in a

specific way: when the MS 101 knows that the new or redefined bearer is going to be used for certain type of transmission, e.g. for voice traffic, interactive video or non-real time data, it selects a previously determined set of QoS parameter values which the device responsible for allocating bearers and/or selecting channel coding and interleaving schemes is able to recognize as an indication of the expected use of the bearer that is to be set up or redefined.

The MS 101 is further capable of endpoint signalling, which means that it may communicate bidirectionally with the other network devices through the signalling channels defined in the system. Naturally the MS 101 is also arranged to use the bearers allocated to it with the QoS accompanied with the allocation, as long as the allocations do not exceed the inherent communication capabilities of the MS. These are all known functions from prior art.

The BS 102 has usually a limited role in bearer setup or redefinition: it simply implements the bearer setup and redefinition commands it receives from the BSC 104 and/or the PCU 103. However, in some systems the BS 102 may be capable of requesting bearer setup or redefinition of its own motion. In such systems the application of the present invention means that when the BS generates a request for bearer setup or redefinition, it selects the QoS parameter values that it will send within the request so that the device responsible for allocating bearers and/or selecting channel coding and interleaving schemes is able to recognize as an indication of the expected use of the bearer that is to be set up or redefined. The BS 102 is also capable of acting as an endpoint and as a link in signalling.

In the present description we will assume that the PCU 103 is the device which is responsible for handling the requests for bearer setup and redefinition and making the decisions concerning the allocation of bearers over the radio interface as well as the characteristics of the bearers. The actual QoS negotiation where the QoS profile is agreed upon is typically performed between a mobile station and an SGSN. According to the preferred embodiment of the invention the PCU is capable of QoS mapping, which means that there exists an unequivocal correspondence between certain selections of QoS parameter values and certain channel coding and/or interleaving schemes. When the PCU 103 receives a request for bearer setup or redefinition, it takes the QoS parameter values contained within the request, maps them into a certain channel coding and/or interleaving scheme and includes those in the bearer allocation, taken that there is enough available capacity in the system for the allocation to be made in the first place.

It may also happen that the QoS parameter values contained within the request indicate a bearer type which is not allocatable for the moment, but a certain other bearer type could be allocated. In such case it is advantageous if the PCU may make a preliminary allocation for a bearer that is as close in type as possible to the requested one, and answer the device requesting the bearer setup or redefinition with that allocation. It is then on the responsibility of the device that made the request to either accept the allocation even if it was not quite the same which was requested, or to reject the allocation and leave the situation as it is. To accomplish this for example the MS must contain a certain "reverse mapping" function with which it may take a certain bearer allocation with a certain choice of channel coding and/or interleaving and to interpret it as an indication of the allocated bearer type. The final decision of whether or not to accept the allocation may even be referred to the user of the MS: if the user had requested a video connection to be set up and nothing better than a normal telephone connection is available, the MS may ask the user whether he is satisfied with a normal telephone connection or whether the attempts for establishing a connection should be terminated altogether.

Fig. 2 illustrates schematically the flow of events in an uplink bearer setup or redefinition process according to an advantageous embodiment. At step 201 the MS recognizes the need for setting up a new bearer or for redefining the characteristics of an existing one. At step 201 the MS is aware of the type of the bearer which is needed: as exemplary bearer types we have given voice traffic, interactive video or non-real time data above. At step 202 the MS maps the bearer type into a certain predefined set of QoS parameter values. The MS sends a request for new bearer (or for the redefinition of an existing bearer) 203 in a manner basically known as such; however the selection of QoS parameter values in the request now signify the type of the requested bearer instead of or in addition to the plain bearer characteristics normally referred to by QoS parameter values of prior art.

The request 203 is routed over the BS to the BSC, where it is found to concern packet data services and consequently routed into the PCU. After having received the request the PCU checks at step 204 the allocation situation of the resources available to packet data services. It may happen that a too large part of the resources are already allocated or some other rule prevents the allocation altogether, in which case the PCU answers the MS simply with a rejection message 205 and the process is terminated. In a hopefully more typical case the PCU goes on to map the set of

QoS parameters in the request into a certain bearer type, meaning especially a selection of channel coding and interleaving.

The step of negotiating a QoS profile is not shown in Fig. 2. It typically involves the SGSN which is the peer of the MS in the QoS negotiation. The SGSN may ask the PCU or other network element about the possibility of allowing a certain QoS profile to be used, taken the capacity and current traffic load situation of a certain BS and/or BSC. If such a request is made and the PCU gives its approval, the SGSN conducts the negotiation to its end in a known way, after which it is on the responsibility of the PCU to use the negotiated QoS profile for mapping it into a certain channel coding and/or interleaving scheme.

Taken the current set of available channel coding alternatives in GPRS, it would be advantageous if additional optimized channel coding schemes would be developed for at least speech and possibly also for real time video. The invention does not limit the actual selection of channel coding methods, but it is known to be advantageous to avoid retransmissions in a speech bearer and to have variable strengths of channel coding for the different parts of a transmission burst. Additionally it is known to be advantageous to have a relatively long interleaving length for speech or real time video: for example the duration of eight or ten transmission frames.

When the PCU has made the allocation for the requested bearer and decided the channel coding and interleaving schemes it signals the allocation to the BS and the MS as illustrated with 207. At this moment the device which requested the bearer setup or redefinition still has the chance to reject the allocation, which mainly applies to cases where the PCU was not able to grant the allocation in its requested form but offers an alternative allocation instead. If the MS accepts the allocation it performs bearer reconfiguration at step 208 more or less simultaneously with a similar operation 209 in the BS, after which the communication continues by using the newly allocated or redefined bearer.

Informing the BS about the channel coding / interleaving scheme to be applied may take place by for example using a certain bit field within a RLC/MAC header (Radio Link Control / Medium Access Control) to indicate a value which the BS is able to unequivocally translate into a certain channel coding / interleaving scheme. The use of a certain channel coding / interleaving scheme may also be stored in the BS according to a certain data flow (TBF, Temporary Block Flow) in certain user.

Fig. 3 is the downlink bearer counterpart of Fig. 2. At step 301 the PCU receives from the network a request concerning a communication connection to a certain mobile station such that a new bearer has to be set up or an existing bearer must be redefined. Step 302 corresponds to step 204 in Fig. 2 and it may result in the request
 5 to be rejected at step 303. If that is not the case the PCU should again find the correct channel coding and/or interleaving scheme for the requested bearer at step 304. If the request contained a predefined set of QoS parameter values, step 304 resembles closely step 206 in Fig. 2. It is also possible that the request indicates in some other way that it concerns a communication connection the type of which is
 10 e.g. voice traffic, interactive video or non-real time data. In that case the mapping function in the PCU should be flexible enough to recognize also such other kinds of indications when they come from the network side.

Having made the allocation with the associated selection of channel coding and
 15 interleaving scheme the PCU signals the allocation by paging the MS through the BS (or a number of BSs) at step 305. The term paging may be replaced with signalling if the MS is already actively communicating with the PCU so that its location in a certain cell is known and it is in an active state. The MS receives the paging and allocation at step 306 and checks whether or not the intended new bearer is within its capabilities. At step 307 it signals either its acknowledgement or rejection (negative acknowledgement) to the PCU through the BS, and if the
 20 acknowledgement was positive, communication with the new bearer may start after bearer configuration update in the MS 308 and the BS 309.

A major advantage of the invention is that existing information structures (i.e. the QoS parameter values) are used to signal requested bearer type to the PCU or other device that makes the decisions concerning bearer allocation and selection of
 25 channel coding and interleaving. We have already indicated that it would be advantageous to define at least one additional channel coding scheme and probably
 30 also one additional interleaving length in systems like GPRS where the existing channel coding schemes and interleaving lengths are far from optimal for the transmission of speech or real time video. That would obviously necessitate some new definitions to be made in the information structures that the PCU or
 corresponding device uses to signal the selected channel coding and interleaving
 35 schemes to the BSs and MSs. If only one additional interleaving length is defined, it suffices to define one additional bit in a signalling structure like the known PCU extended data frame header: a first value of said additional bit signifies the known interleaving length of one RLC block an a second value of said additional bit

signifies the new additionally defined interleaving length which can be e.g. two RLC blocks which is equal to eight transmission bursts. If one or several additional channel coding schemes are defined, other additional bits to e.g. the PCU extended data frame header must be defined.

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Fig. 4 illustrates schematically a mobile station 401 that can be used to implement the method according to the invention. The hardware of the mobile stations comprises a radio transceiver block 402, a decoding/demultiplexing block 403, an encoding/multiplexing block 404, a control block 405 and a user data part 406. The decoding/demultiplexing block 403 is arranged to separate received signalling information from received user data and to direct the former into the control block 405; similarly the encoding/multiplexing block 404 is arranged to take signalling information from the control block 405 and to multiplex it for transmission with user data coming from the user data part 406. All other blocks operate under the supervision of the control block. The control connections are shown with thinner lines than the user data and signalling information connections. To make the mobile station to operate in accordance with the invention the functions of mapping user data requirements to QoS parameter values, possibly the reverse mapping of negotiated QoS parameter values into bearer types and the handling of bearer allocation requests is programmed into the form of processor-executable instructions so that the control block 405 is able to operate according to them.

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CLAIMS

1. A method for choosing a channel coding and/or interleaving scheme to be applied in a communication connection over a radio interface between a terminal and a base station of a cellular packet radio system where a certain decision-making

5 device allocates channel coding and/or interleaving schemes to communication connections, comprising the steps of:

- communicating a request message to the decision-making device, said request message indicating a certain set of Quality of Service parameters associated with a certain first communication connection,

10 - mapping said set of Quality of Service parameters to a certain first channel coding and/or interleaving scheme as a part of the channel coding and/or interleaving scheme allocation made by the decision-making device and

- communicating said first channel coding and/or interleaving scheme to the base station and the terminal for them to apply said first channel coding and/or interleaving scheme in said first communication connection.

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2. A method according to claim 1, wherein

- the step of communicating a request message to the decision-making device comprises the mutually alternative substeps of

20 a1) indicating, within said set of Quality of Service parameters, high service precedence, short mean delay and short maximum delay when the request message concerns a certain communication connection for transmitting real-time speech and/or real-time video image, or

25 a2) indicating, within said set of Quality of Service parameters, low service precedence, long mean delay and long maximum delay when the request message concerns a certain communication connection for transmitting non-real time data;

and

- the step of mapping said set of Quality of Service parameters to a certain first channel coding and/or interleaving scheme comprises the mutually alternative substeps of

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b1) mapping a set of Quality of Service parameters indicating high service precedence, short mean delay and short maximum delay into a channel coding scheme with no retransmissions and a long interleaving length, or

35 b2) mapping a set of Quality of Service parameters indicating low service precedence, long mean delay and long maximum delay into a channel coding scheme with retransmissions and a short interleaving length.

3. A method according to claim 2, wherein step b1) further comprises the feature of mapping said set of Quality of Service parameters indicating high service precedence, short mean delay and short maximum delay into a channel coding scheme which is optimized for speech.

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4. A method according to claim 1, wherein the step of communicating a request message to the decision-making device is executed as a response to an observed need for setting up a new radio bearer between the terminal and the base station.

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5. A method according to claim 1, wherein the step of communicating a request message to the decision-making device is executed as a response to an observed need for changing the characteristics of an existing radio bearer between the terminal and the base station.

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6. An arrangement for choosing a channel coding and/or interleaving scheme to be applied in a communication connection over a radio interface, comprising:

- a terminal, a base station and a radio interface between them,
- a certain decision-making device for allocating channel coding and/or interleaving schemes to communication connections,

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- within the terminal and the base station, means for communicating a request message to the decision-making device, and means for indicating within said request message a certain set of Quality of Service parameters associated with a certain first communication connection,

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- within the decision making device, means for mapping said set of Quality of Service parameters to a certain first channel coding and/or interleaving scheme as a part of the channel coding and/or interleaving scheme allocation and

- means for communicating said first channel coding and/or interleaving scheme to the base station and the terminal for them to apply said first channel coding and/or interleaving scheme in said first communication connection.

ABSTRACT

A method is disclosed for choosing a channel coding and/or interleaving scheme to be applied in a communication connection over a radio interface between a terminal (101) and a base station (102) of a cellular packet radio system. A certain decision-making device (103) allocates channel coding and/or interleaving schemes to communication connections. A request message is communicated (203) to the decision-making device, said request message indicating a certain set of Quality of Service parameters associated with a certain first communication connection. Said set of Quality of Service parameters is mapped (206, 304) to a certain first channel coding and/or interleaving scheme as a part of the channel coding and/or interleaving scheme allocation made by the decision-making device. Said first channel coding and/or interleaving scheme is communicated (207, 305) to the base station and the terminal for them to apply said first channel coding and/or interleaving scheme in said first communication connection.

Fig. 1

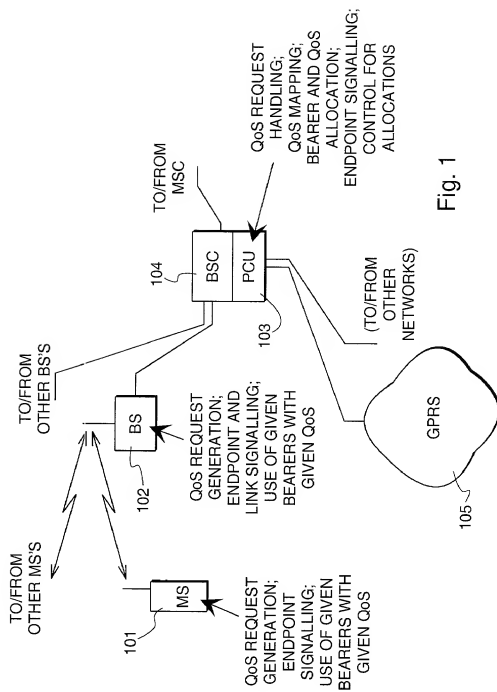


Fig. 1

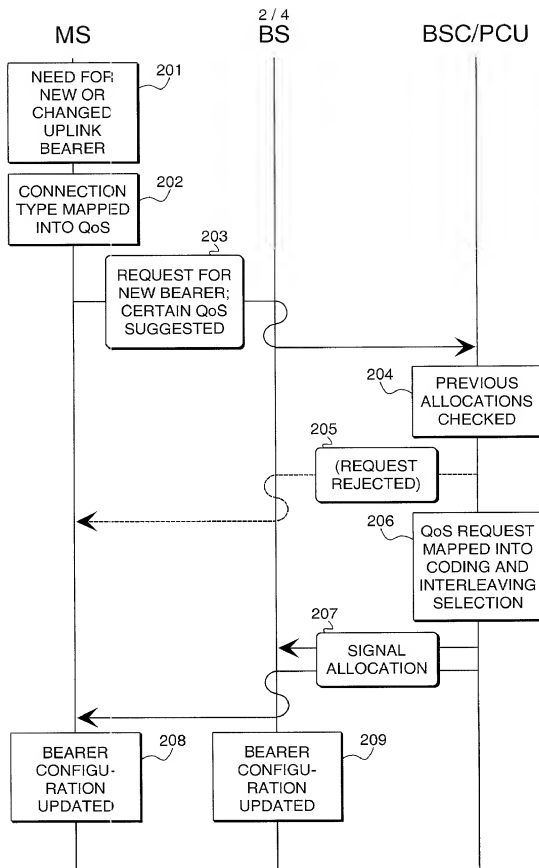


Fig. 2

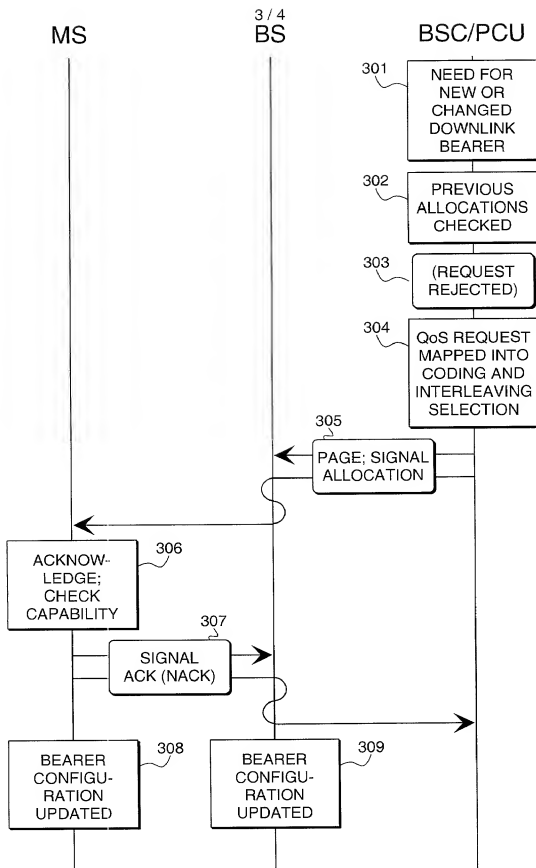


Fig. 3

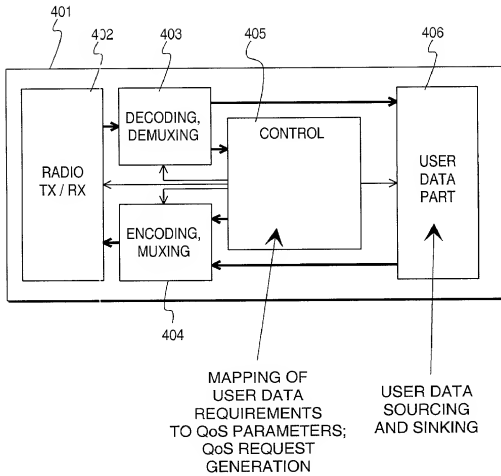


Fig. 4